



Facts on California's Use of Hydroelectricity

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California has approximately 14,000 megawatts (MW) in hydrogeneration capacity, or about 25 percent of electricity production capacity. The Federal Energy Regulatory Commission (FERC) licenses approximately 85 percent of the state's hydroelectric capacity with license terms that can run anywhere from 30 to 50 years. Annual in-state hydroelectric production varies from year to year. Currently it averages about 14 percent of total in-state power production, down from closer to 60 percent in the 1950s. The physical hydrogeneration system is little changed in any significant way since the 1970s.

Concerns about hydrogeneration in California center on three snowpack regions: the Northern Sierra and Trinity, Central Sierra, and Southern Sierra. While alternative means of generating electricity exist, replacement costs are expected to be higher and air emissions greater from alternative sources.

Types of Hydrogeneration Facilities in California

Energy Commission staff identifies three basic types of hydrogeneration facilities within California: conventional, pumped storage, and multi-purpose reservoirs.¹

1. Conventional Hydrogeneration Plants

Conventional hydrogeneration plants are far more numerous than the other two combined, but account for less than half of the state's hydrogeneration capacity in megawatts. Most were built by the state's investor and publicly owned utilities in mountainous areas and are heavily dependent on snowmelt runoff.

- 287 plants (total of 432 water turbines)
- ~6,000 MW total capacity
- Most constructed by electrical utilities, typically in mountainous areas, often connected to non-power reservoirs at even higher elevations.
- Depend on precipitation (especially snowmelt runoff) to supply fuel water to generate electricity.
 - Run fewer hours when water supply is reduced
 - Utilities monitor the snowpack and conserve water in high elevation reservoirs to be used in summer months when electricity demand and electricity prices are highest.

2. Pumped Storage

Pumped storage moves a supply of water from an upper body of water, drops it through generators, and then collects the water in a lower basin. Generation takes place when electricity demand and prices are high, such as a summer afternoon and evening. Water is pumped from the lower basin to the upper when electricity demand and prices are low, to be used during next high demand period. Re-use of water in pumped-storage makes these facilities far less dependent on precipitation than the other two types.

- 4 plants (total of 13 water turbines)
- ~2,800 MW total capacity
- Almost fully independent from snowpack levels.

¹ These describe California's mixture and usage better than the types based on "diversion" (e.g., run-of-river), impoundment, and pumped storage.

- Generate electricity when:
 - Needed for grid reliability.
 - Significant price differences between peak and off-peak power exist.
- There are four true Pumped Storage plants in California:
 - Helms (PG&E): Capacity 1,212 MW; average 2001-12 generation 256 GWh
 - Castaic (LADWP): Capacity 1,440 MW; average 2001-12 generation 352 GWh
 - Eastwood SCE): Capacity 200 MW; average 2001-12 generation 193 GWh
 - Lake Hodges (under contract to SDG&E): Capacity 40 MW; average 2011-12 generation 18 GWh (started operations in 2011)

3. Multi-Purpose Reservoirs

Multi-purpose reservoirs are more numerous than pumped-storage. Their main purpose is water supply for municipal, industrial, and agricultural uses, recreation, and flood control. Hydroelectric generation is a lower priority.

- 79 plants (total of 171 water turbines)
- ~5,200 MW total capacity
- Built by federal, state, regional, and local agencies primarily for water supply and flood control.
 - Hydrogeneration helps pay for costs of construction and operations
 - Many can be called upon to generate during an emergency to maintain grid reliability
 - Includes pumping-generating plants (with reversible turbines) that can store and release water at facilities such as Diamond Valley Lake (MWD) and O'Neill (federal Central Valley Project).

Out-of-State Hydrogeneration Serving California

Pacific Northwest (PNW)

- PNW is highly dependent on hydroelectric generation (approx. 66 percent).
- The largest hydroelectric system is the Columbia River.
- Conditions in the PNW can change unexpectedly, as in 2001 when projections of good precipitation were ruined in less than six months.

Why PNW hydrogeneration is not an issue now (2014)

- PNW power authorities are projecting surpluses of hydrogeneration through 2018.
 - Even though regional precipitation is about 80% of normal.
- Hydrogeneration from the PNW is not a large provider of electricity to California
 - Supplies specified as hydrogeneration is about 0.02 percent of California's electricity supply in a good hydro year (2011) and about 1/5th that in a drier year (2012).

Why keep an eye on PNW?

- During poor hydro conditions, PNW relies on other forms of electricity generation mostly fossil from both within the PNW and from the rest of the western region.
- The PNW situation has been volatile in the recent past.

Pacific Southwest (PSW)

- The PSW is less dependent on hydroelectricity than the PNW, with about 10 percent of its electricity needs met by hydroelectricity.
 - PSW has a broader range of generation alternatives, primarily natural gas-fired.

- The largest hydroelectric system in the PSW outside California is the Lower Colorado.
- California is more dependent on PSW hydroelectric generation than on PNW.
 - About 0.6% of California's electricity demand is met by firm PSW hydrogeneration supplies that are specified as hydrogeneration.
- Hoover Dam provides 12 jurisdictions in California with energy.
 - The US Bureau of Reclamation is required to provide energy should Hoover Dam generation not be sufficient.

Percent of Available Hoover Generation

Firm Generation To:	%
Arizona	19.0
Nevada	25.2
California	55.8
LADWP	15.4
MWD of SoCal	28.5
SCE	5.5
Azusa, Anaheim, Banning, Burbank, Colton, Glendale, Pasadena, Riverside, Vernon	6.4

Why PSW hydrogeneration is not an issue now (2014)

- Non-California PSW hydroelectric generation conditions should remain good through at least 2015.
- Hoover Dam power hydrogeneration is not expected to be affected through at least 2015
 - Precipitation (snow and rain) in Upper Colorado basin is 96 percent of normal - supplies Lake Powell.
 - Lake Powell provides Lake Mead/Hoover Dam system with highly regulated and managed supplies.
 - Lake Mead:
 - High-water line is at 1,229 feet above sea level.
 - Current level is 1,109 feet.
 - Hydroelectric generation stops at 1,050 feet.
 - Lowest projected through current USBR planning cycle (Dec 2015) is 1,080 feet in Sep 2015.
 - Levels are expected to return to 1,084 in Dec 2015.